Vic Pack

VP074

The audiogenic monitor

INSTRUCTION MANUAL

MACHINE CODE PROGRAMMING AIDS FOR THE VIC-20

audiogenic LTD

AUDIOGENIC MONITOR

by Dave Middleton

Introduction

The Audiogenic machine code Monitor is designed to allow the programmer to enter, modify and examine machine code on the VIC as simply as possible. The Audiogenic Monitor comes in two different forms - either as part of our BUTI Plus cartridge (VP052), which is our programming aids cartridge comprising the Monitor, plus BUTI, our Basic toolkit ROM, plus 3K memory expansion, or as a cartridge containing the Monitor alone (VP074). The 17 Monitor commands, including assembler, disassembler and Centronics printer interface, are the same for both versions.

In both cases the Monitor is initialised by typing:-

```
SYS24576  [return]
```

The following message will be printed:-

```
* AUDIOGENIC MONITOR *
  BY: DAVE MIDDLETON

   PC  SR AC XR YR SP
; 0000 20 00 00 00 F8
.
```

There are three interrupt vectors implemented in the VIC, these being: NMI, IRQ and BRK. It is the break vector which is modified to point to the monitor. Once the BRK vector has been changed, if a $00 (BRK) instruction is encountered in a program the monitor will be entered with the following message:-

```
BREAK
   PC  SR AC XR YR SP
; 6020 22 41 00 85 F2
```

Notice that the register values in the BREAK entry are the correct values.

If STOP/RESTORE are pressed, the BRK vector is returned to its normal value and control is passed back to Basic. SYS24576 will call the monitor again.

The monitor uses only six locations in the zero page - $A7, $A8, $FC - $FF. The Basic input buffer is also used ($200 - $240).

Summary of Monitor Commands

A - Assemble machine code using 6502 mnemonics.
C - Switch on Centronics interface.
D - Disassemble machine code anywhere in the VIC.
F - Fill an area of memory with a specific character.
G - Start executing machine code without intervention from the monitor.
H - Search memory for specific bytes or ASCII character strings.
L - Load memory from either disk or tape.
M - Display memory.
P - Continuous disassembler.
Q - Execute machine code, display only the program counter for speed.
R - Display the contents of the 6502 registers.
S - Save memory to tape or disk.
T - Transfer memory from one area to another.
W - Step through machine code disassembling each line, and show the registers.
X - Exit to Basic, leaving BRK vector modified.
: - Modify memory.
; - Modify the 6502 registers.

Commands in Detail

Command: A
Action : Assemble machine code.
Syntax : A address opcode operand

Eg.

```
A 1000 LDX #$15
A 1002 LDA #$A0
A 1004 STA $1E00,X
A 1007 LDA #$00
A 1009 STA $9600,X
A 100C DEX
A 100D BPL $1002
A 100F BRK
```

The above program will draw a black line across the top of the screen on a VIC with the screen at 7680 ($1E00).
All of the standard Commodore mnemonics are used. See the 6502 Programming Manual, or the VIC Programmers Reference Guide for full explanations of each opcode.

The following table shows the 13 addressing modes available on the VIC:-

Name	Example
Implied	LSR
Immediate	LDA #$41
Absolute	STA $1E00
Zero Page	LDA $00
Relative	BNE $1002
Absolute Indexed	STA $1E00,X
	STA $1E00,Y
Zero Page Indexed	STA $00,X
	STA $00,Y
Indexed Indirect	LDA ($00,X)
Indirect Indexed	LDA ($00),Y
JMP/JSR Absolute	JMP $1000
JMP Indirect	JMP ($1000)

Command: C
Action : Change the VIC output vector to allow a Centronics parallel printer on the user port.
Syntax : C

For a full explanation of this command, please refer to the Centronics Interface manual.

Command: D
Action : Disassembler machine code to the screen.
Syntax : D start-address
Eg.

.D 1000

The screen will clear and a page of disassembly will be printed.

```
: 1000 A2 15
A 1000 LDX #$15
: 1002 A9 00
A 1002 LDA #$A0
: 1004 9D 00 1E
A 1004 STA $1E00,X
: 1007 A9 00
A 1007 LDA #$00
: 1009 9D 00 96
A 1009 STA $9600,X
: 100C CA
A 100C DEX
: 100D 10 F1
A 100D BPL $1002
: 100F 00
A 100F BRK
: 1010 FF 15
D 1010 ???
```

The cursor will be positioned on the last line of the screen, and if RETURN is pressed now the next page of disassembly will be shown. By moving the cursor up it is possible to modify memory or re-assemble a line directly, something which is not possible with other monitors.

```
Command: F
Action : Fill an area of memory with the same byte.
Syntax : F start-address end-address byte
Eg.

.F 1000 1E00 00
```

The above will fill the area from $1000-$1E00 with zero's.

```
Command: G
Action : Go and execute machine code at full speed.
Syntax : G address    or    G
Eg.
```

If G is given by itself the value currently in the program counter is used:-

```
   PC  SR AC XR YR SP
; 1000 22 41 20 35 F8
.G

Execution will start at $1000


Command: H
Action : Hunt through memory for a string or a sequence of bytes.
Syntax : H start-address end-address 'hello
         H start-address end-address byte byte byte ...
Eg.

H 1000 1E00 'HELLO
1C00

H 1000 1E00 A9 41
1002 1090 1100 1210
1C00 1D0F
```

In the first example the string "hello" started at $1C00, in the second example six occurences of $A9 $41 were found. Note the use of the single quote without a terminating quote.

```
Command: L
Action : Load machine code from a storage device.
Syntax : L "0:NAME",08      load from disk
         L "NAME"           load named file from cassette
         L                  load first file from cassette
```

```
Command: M
Action : Display memory.
Syntax : M start-address  end-address
         M start-address
Eg.

.M 1000 1010
: 1000 A2 15 A9 41
: 1004 00 00 00 00
: 1008 00 00 00 00
: 100B 00 00 00 00
: 1010 00 00 00 00

.M 1000
: 1000 A2 15 A9 41


Command: P
Action : Printing disassembler
Syntax : P start-address  end-address
```

The printing disassembler outputs code in the same manner as the normal disassembler execpt it does not stop at the bottom of the screen and wait for carriage return to be pressed. The main use of P is in disassembling code to a printer, this is achieved in the following manner:-

From BASIC enter the following:-

```
OPEN4,4:CMD4:SYS24576
```

The printer will output the sign on message and the cursor will flash on the screen. Enter the command, sit back and wait!

When the code has all been outputted type the following:-

```
X [return]
PRINT#4:CLOSE4
```

Re-enter the monitor with either SYS9 or SYS24576

```
Command: Q
Action : Quick trace
Syntax : Q
```

The address where the trace is to start is held in the program-counter. As each instruction is executed the current position of the program counter is output. The user has to press the space bar between each instruction. If 'W' is pressed Walk mode is entered and if the STOP key is pressed control is passed back to the main command entry point. Note that if a BRK command is encountered trace automatically terminates.

Command: R
Action : Register display
Syntax : R
Eg.

```
.R
   PC  SR AC XR YR SP
; 1000 22 41 20 35 F8
```

PC - Program counter
SR - Status register
AC - Accumulator
XR - X register
YR - Y register
SP - Stack Pointer

New values can be entered by moving the cursor over any value and changing it.

Command: S
Action : Save machine code to a device.
Syntax : S "NAME" , device-number , start-address , end-address
Eg.

```
S "TEST",08,1000,1E00
```

This will save the block of machine code from $1000-$1E00 to device 8 with the name TEST. Note the commas are a necessary part of the command.

Command: T
Action : Transfer machine code from one area of memory to another
Syntax : T from-address to-address bytes-count
Eg.

```
.T 1000 1300 0200
```

The above will transfer 512 bytes from $1000 to $1300

Command: W
Action : Walk through a program
Syntax : W

The address where the trace is to start is held in the program-counter. As each instruction is executed the current values of the registers are output and the instruction is disassembled. The user has to press the space bar between each instruction. If 'Q' is pressed Quick trace mode is entered and if the STOP key is pressed the registers are dumped and control is passed back to the main command entry point. Note that if a BRK command is encountered trace automatically terminates.

Eg.

```
    PC  SR AC XR YR SP
; 1000 20 00 00 00 F8
.W

    PC  SR AC XR YR SP
; 1000 20 00 00 00 F8
: 1000 A2 20
A 1000 LDX #$20

    PC  SR AC XR YR SP
; 1002 20 00 20 00 F8
: 1000 A9 A0
A 1000 LDA #$A0

    PC  SR AC XR YR SP
; 1002 20 00 20 00 F8
.
```

Assuming that the STOP key has been pressed the cursor will now be flashing. Any of the registers can now be modified and if W is entered again the trace will resume with the new values in the registers.

Command: :
Action : Modify memory
Syntax : : address byte byte byte byte

It is not expected that the user will enter this command. The VIC outputs it automatically as a result of a memory dump or as part of a disassembly. Simply move the cursor over the existing values, modify them and press return.

Command: ;
Action : Modify registers.
Syntax : ; address byte byte byte byte byte

It is not expected that the user will enter this command. The VIC outputs it automatically as a result of a register dump. Simply move the cursor over the existing values, modify them and press return.

Command: X
Action : Exit to Basic
Syntax : X

This command returns control to the Basic interpreter. The monitor can be reentered either by SYS24576, or by giving a SYS call to a convenient zero.

Tracing Basic from Machine Code

The Audiogenic Monitor can also follow the Basic interpreter as it interprets Basic; Here's how....

Set locations 0 = $0 and 2 = $60

For example.... 10 SYS0:POKE1,1

The statement to be interpreted (in this case POKE1,1) follows the SYS call. Keep numbers short as they take ages to interpret. Run the program. Basic will drop into the monitor. Type W, press return, and watch the Basic execute.

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